

(12) **United States Patent**
Whitaker

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- (54) **HALF-BARREL INTAKE SCREEN**
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B01D 35/02 (2006.01)
- (52) **U.S. Cl.**
CPC **E02B 5/085** (2013.01); **B01D 29/33**
(2013.01); **B01D 35/02** (2013.01); **C02F**
2303/24 (2013.01)
- (58) **Field of Classification Search**
None
See application file for complete search history.

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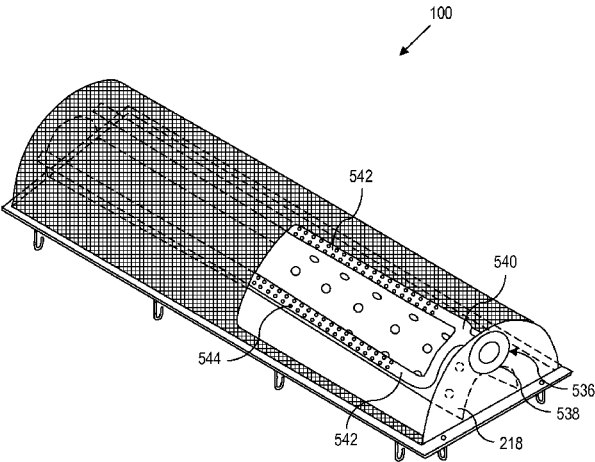
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(57) **ABSTRACT**

A half-barrel intake screen is disclosed. The half-barrel intake screen comprises a frame including a first end, a second end, and a bottom coupled between the first end and the second end. Further, a contiguous screen segment couples between the first end and the second end of the frame. However, the screen segment couples to the frame independently of a concrete body having an outlet. In other words, the intake screen does not include a concrete body having an outlet.

18 Claims, 5 Drawing Sheets



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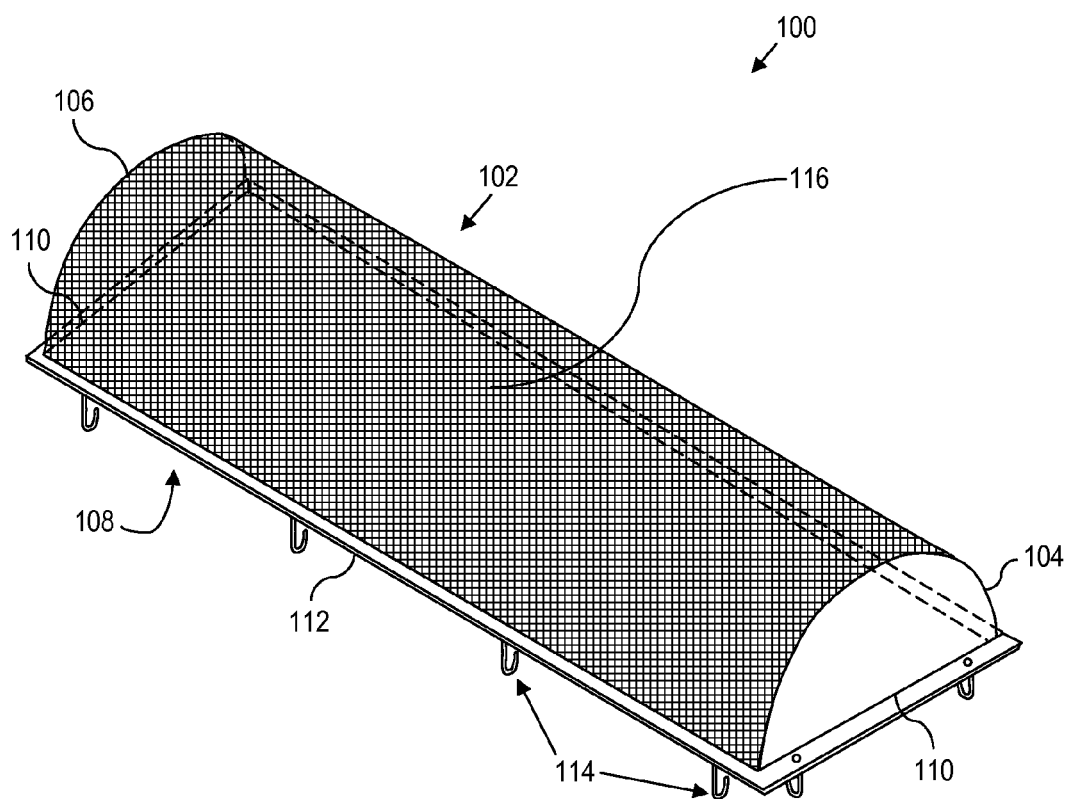


FIG. 1

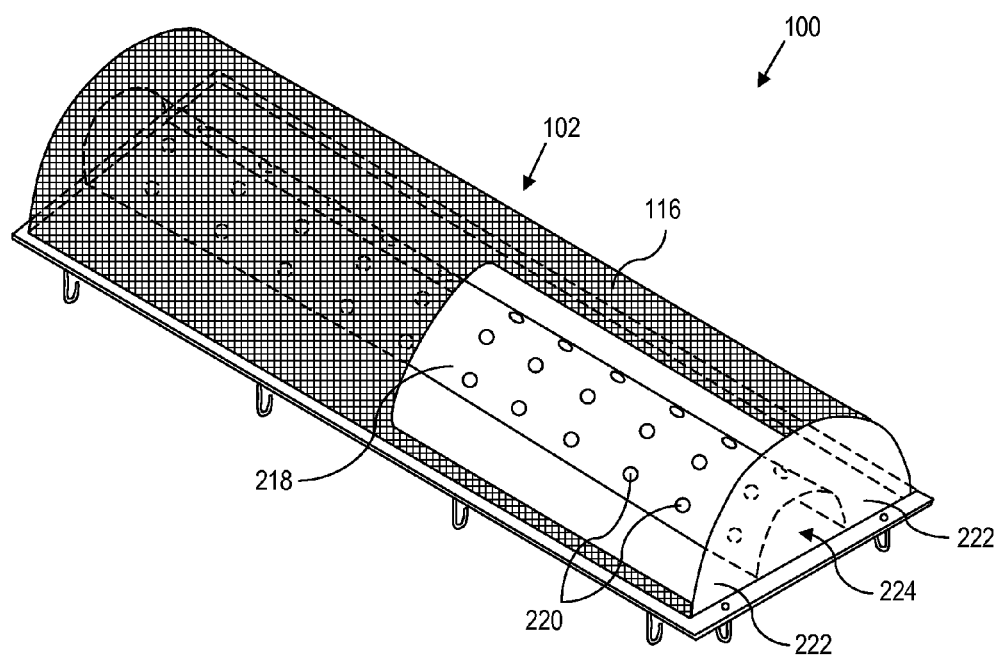


FIG. 2

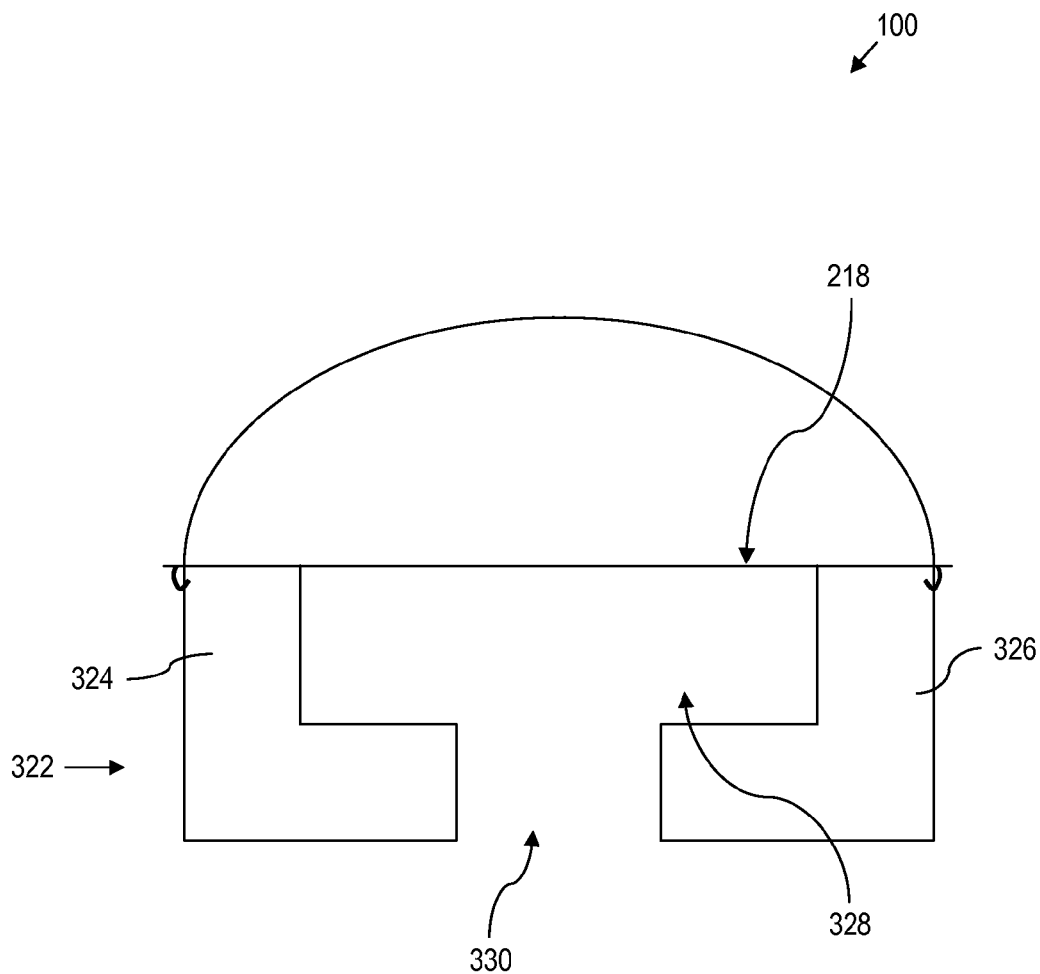


FIG. 3

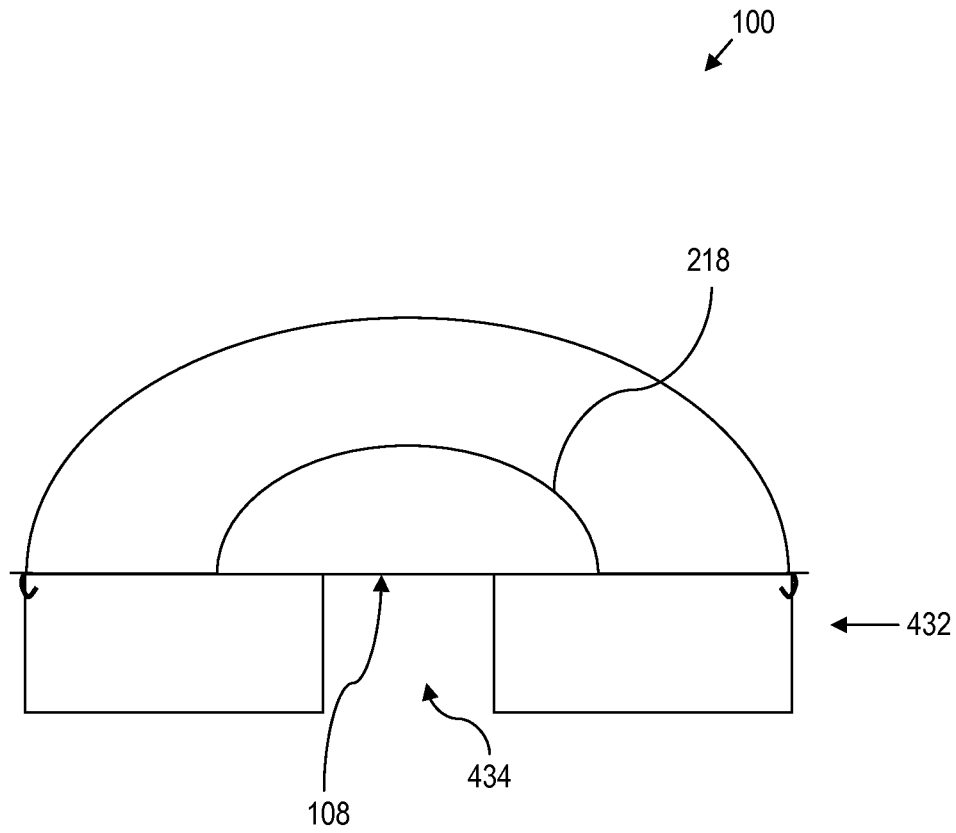


FIG. 4

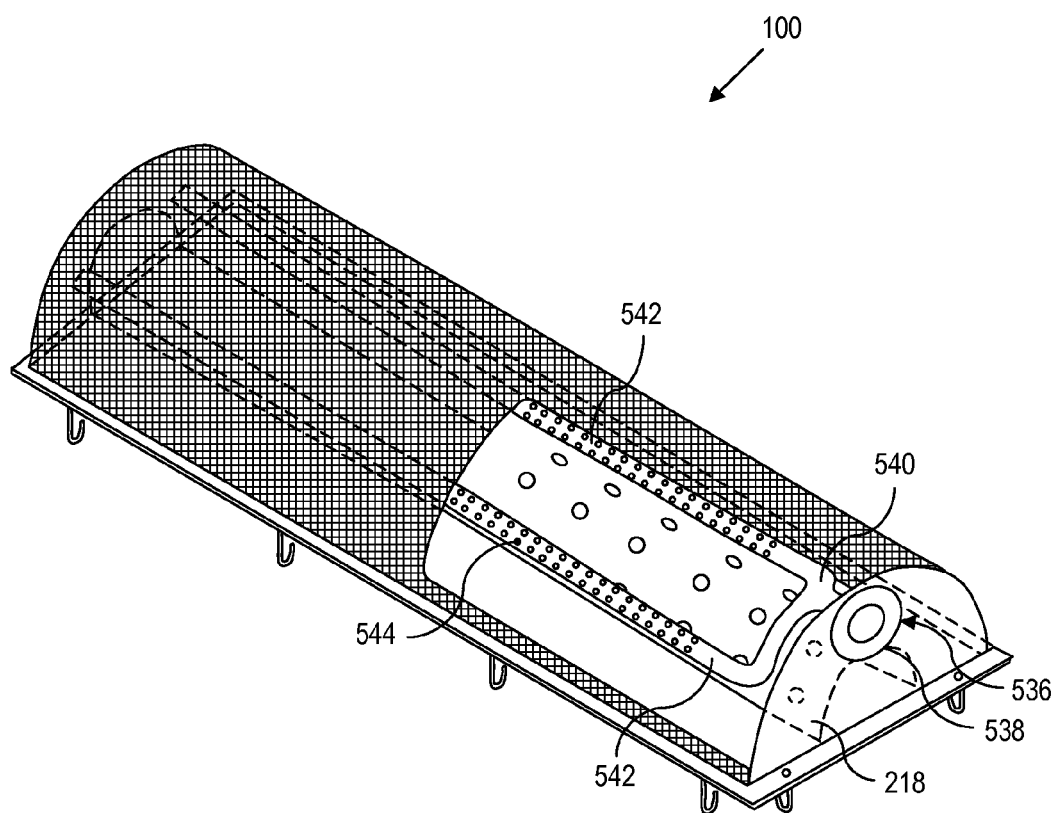


FIG. 5

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HALF-BARREL INTAKE SCREEN**BACKGROUND**

Various aspects of the present invention relate generally to water diversion and specifically to water intake screens used in water diversion.

Water is required for many aspects of business and everyday life, and most of our water comes from natural resources (e.g., lakes, rivers, streams). For example, a water company may divert water from a lake or stream through a channel or system of channels to a treatment facility. Also, farmers may divert water for irrigating crops.

Water diversion techniques are divided into two general types: gravity and pumped. In gravity water diversion, the water is diverted into a channel or pipe leading off of the water source, and the flow is controlled by gravity. However, in pumped water diversion, the water is diverted into a pipe, and a mechanical pump removes the water from the source.

To help ensure that no debris, fish, or the like gets into the pipe or channel, a water intake screen is placed over an inlet to the pipe or channel. Most water intake screens include a hollow, central body with an outlet that couples to the channel used to take the water to the water treatment plant. Screened areas on both sides of the body allow water to enter while blocking out debris and fish. Thus, most water intake screens resemble a large cylinder including two screened sections and an outlet that mounts to the channel.

BRIEF SUMMARY

According to aspects of the present disclosure, a half-barrel intake screen is disclosed. The half-barrel intake screen comprises a frame including a first end, a second end, and a bottom coupled between the first end and the second end. Further, a contiguous screen segment couples between the first end and the second end of the frame. However, the screen segment couples to the frame independently of a concrete body having an outlet. In other words, the intake screen does not include a concrete body having an outlet.

According to further aspects of the present disclosure, the half-barrel intake screen described above attaches to a base. The base may be a vaulted base or a standard base.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

FIG. 1 is a diagram illustrating a half-barrel intake screen according to various aspects of the present disclosure;

FIG. 2 is a diagram illustrating a half-barrel intake screen with a half-barrel flow modifier, according to various aspects of the present disclosure;

FIG. 3 is a diagram illustrating a half-barrel intake screen with a flat flow modifier mounted on a vaulted base, according to various aspects of the present disclosure;

FIG. 4 is a diagram illustrating a half-barrel intake screen mounted on a flat base, according to various aspects of the present disclosure; and

FIG. 5 is a diagram illustrating a half-barrel intake screen with an airburst system, according to various aspects of the present disclosure.

In the Figures, like elements are referenced with like reference numbers.

DETAILED DESCRIPTION

According to aspects of the present disclosure, a water intake screen is provided and is suitable to divert debris, fish,

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etc. from entering channels and pipes associated with water diversion. The water intake screen may be used in gravity or pumped water diversion systems and may be active (including a debris removal system) or passive (lacking a debris removal system). As will be described in greater detail herein, the water intake screen is a half-barrel intake screen that includes a contiguous screened area coupled between two ends of the intake screen. Because the screened area is contiguous, the intake screen does not include a hollow body with an outlet. Instead, the water flows into the intake screen and out of the bottom of the intake screen.

Turning now to the figures and in particular FIG. 1, a half-barrel water intake screen **100** is shown. The half-barrel intake screen includes a frame **102** comprising a first end **104**, a second end **106**, and a bottom **108**. The first and second ends **104**, **106** can be any desired shape that includes at least one generally flat side **110**.

For example, the first and second ends **104**, **106** may be partially circular (e.g., a quarter of a circle, a semicircle, three-quarters of a circle, or otherwise any amount less than a full circle, a simple or complex rounded or otherwise curved section in general (e.g., partial ellipse, partial oval, etc.), etc.). Other examples include a triangle, a rectangle, an amorphous shape with at least one generally flat side, etc. Further, the first end **104** may be identical to the second end **106**. Alternatively, the first end **104** may be different from the second end **106**, (e.g., larger, smaller, a different shape, etc.).

Moreover, the first end **104**, the second end **106**, or both may be solid (as shown in FIG. 1). Alternatively, the first end **104**, the second end **106**, or both may include one or more features, such as a screen, a port, etc. Still further, the first end **104**, the second end **106**, or both may be three dimensional (e.g., concave, convex, pointed, conical, etc.).

As shown, the first end **104** and the second end **106** are perpendicular to the bottom **108**; however there is no such requirement. In other words, the first end **104** and the second end **106** are not required to be perpendicular to the bottom **108** or parallel to each other **104**, **106**.

The bottom **108** of the frame **102** is coupled between the first end **104** and the second end **106** and creates a length for the intake screen **100**. Further, the bottom **108** of the frame **102** includes a flange **112** running along the perimeter, so the intake screen **100** can be mounted to a base, as described in greater detail below. The flange **112** includes fasteners **114** that couple the intake screen **100** to the base. As illustrated, the fasteners **114** are hooks that may be embedded into the base or may hook onto loops embedded into the base. However, other types of fasteners **114** may be utilized (e.g., bolts, spikes, etc.). Moreover, the bottom **108** of the frame **102** includes an aperture configured such that water entering the intake screen **100** leaves through the aperture. The aperture may be any desired size, depending on a desired flow rate, a type of base utilized, and other devices present in the intake screen **100**. For example, the aperture may be the entire space between the outline of the flange **112**.

A contiguous screen segment **116** couples between the first end **104** and the second end **106** of the frame **108**. In other words, as shown, there is one screen segment **116** running the length of the intake screen **100**. Moreover, as will be described in greater detail herein, the contiguous screen segment **116** is coupled to the frame **102** independently of a body (e.g., a concrete body) having an outlet. In an illustrative implementation, the screen segment **116** defines a contiguous screen segment that couples directly to the first end **104**, the second end **106**, and the bottom **108** and runs the entire length of the intake screen **100**. In an alternative implementation, the contiguous screen segment **116** can indirectly couple to the

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first end **104**, the second end **106**, and the bottom **108** (e.g., through a framing, bracketing, other suitable structures, etc.).

The screen segment **116** may follow the shape of one or both of the first end **104** and the second end **106** to make a three dimensional shape associated with the two dimensional shape of the first end **104** and the second end **106** (i.e., a prism). For example, if both of the first end **104** and the second end **106** are partially circular (as shown in FIG. 1), then the screen segment **116** can uniformly run between the two ends, creating a partially circular prism. In other words, the screen segment **116** may include a uniform cross section along the length of the intake screen between the first end **104** and the second end **106**. As another example, if the first end **104** and the second end **106** are each triangular, then the screen segment **116** can make a triangular prism.

Alternatively, the contiguous screen segment **116** can make non-uniform shapes. For example, the intake screen **100** can have one partially circular end and a rectangular end, and the screen segment **116** creates a shape that starts as a partially circular prism and gradually morphs into a rectangular prism along the length of the screen. As another example, the first end **104** and the second end **106** may be congruent (e.g., defined by a partially circular shape), but the screen segment **116** gradually increases or decreases (or both at different points) in radius along the length. As such, while the illustrated embodiment of the half-barrel intake screen **100** is a uniform partially circular prism, other shapes that include at least one flat edge on the first end **104** and the second end **106** are within the scope of the present disclosure.

The screen segment **116** may be made of any suitable material such as wedge wire, profile bar, etc., which can be of any suitable metal, e.g., stainless steel, a copper-nickel alloy, etc.

The intake screens **100** described herein have been described as three dimensional shapes. However, as will be understood, the screen segment **116** couples to the frame **102** to make a generally hollow three dimensional shape with a generally open bottom **108**. Thus, a fluid passes through the screen segment **116** to the hollow section of the intake screen **100** and out of the bottom **108**.

Turning now to FIG. 2, a half-barrel intake screen **100** with a flow modifier **218** is illustrated. The intake screen **100** includes a frame **102** and a contiguous screen segment **116**. To show the flow modifier **218**, a section of the screen segment **116** has been cut away. The flow modifier **218** is provided to ensure a desired flow of water over the length of the intake screen **100**. In general, the flow modifier **218** is disposed on the bottom **108** of the frame **102** and runs the length of the frame **102**.

The flow modifier **218** of FIG. 2 is a partially circular prism that runs the entire length of the screen segment **116**. Moreover, the flow modifier **218** is concentric with the partially circular prism shape of the screen segment **116**, and includes holes **220** which allow a fluid to flow from outside the flow modifier **218** to inside the flow modifier **218**. The fluid passing through the holes **220** exits the bottom **108** of the intake screen **100**.

To ensure the flow modifier **218** works properly, the bottom **108** of the frame **102** may be open only on the inside of the flow modifier **218** and closed on the outside of the flow modifier **218**. That is, the bottom **108** may include solid panels **222** that flank an opening **224** defined by the interior of the flow modifier **218**. Thus, all of the fluid that exits the bottom **108** of the screen (e.g., to go to a water treatment plant) must pass through the flow modifier **218**. However, in an alternative implementation, the flow modifier **218** may be designed such that only some of the fluid needs to pass to the

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inside of the flow modifier **218** while other fluid can exit through the bottom **108** outside of the flow modifier **218**. In such a case, the bottom **108** of the frame **102** may be open both inside and outside of the flow modifier **218** (i.e., the solid panels **222** are not necessary).

While shown as a concentric, partially circular prism, the flow modifier **218** may take on other shapes so long as the flow modifier **218** to influence the flow mechanics of the flow modifier **218** (i.e., to alter the flow of the water through the intake screen **100** to meet the designed-for requirements of the intake screen **100**). For example, the flow modifier **218** may be generally flat across the bottom **108** of the frame **102**. As another example, the flow modifier may be a partially circular prism that is non-concentric with the screen segment **116**. In a further example, the flow modifier may be a triangular prism. Thus, the shape of the screen segment **116** does not necessarily dictate the shape of the flow modifier **218**.

The number, size, placement, and shape of the holes **220** may also be utilized to influence the flow mechanics of the flow modifier **218**. As such, the holes **220** may take on other shapes (e.g., round, slits, etc.). Moreover, the holes **220** may take on any size (including being uniform or varying in size), the holes **220** may be located at any location on the flow modifier, any number of holes **220** may be utilized, and any combination of the above may be utilized to meet the desired flow properties of the particular implementation of the intake screen.

Turning now to FIG. 3, a cross section view illustrates a half-barrel intake screen **100** mounted on a vaulted base **322**. The configuration of the vaulted base **322** defines a hollow portion **328** that leads to a channel **330**. More particularly, the intake screen **100** is a partially circular prism in shape and includes a flat flow modifier **218**. The vaulted base **322** includes two walls **324**, **326** that position the intake screen **100** above the hollow portion **328** and the channel **330** of the base **322**.

When a screening system comprising the half-barrel intake screen **100** and the vaulted base **322** is disposed in a water source, water flows through the screen segment **116** to enter the intake screen **100**. Then, the water flows through the flow modifier **218** to the hollow portion **328** of the base **322**, where the water flows out the channel **330**.

As shown in FIG. 3, the intake screen **100** is a partially circular prism in shape and includes a flat flow modifier **218**. However, with a vaulted base **322**, the intake screen **100** may be of any shape and may include any (or no) flow modifier, as described more fully herein with reference to FIGS. 1 and 2.

FIG. 4 is a cross section of a half-barrel intake screen **100** mounted on a standard base **432** that does not include a hollow portion. The intake screen **100** is a partially circular prism in shape and includes a partially circular prism-shaped flow modifier **218**. The standard base **432** positions the intake screen **100** above a channel **434**.

When a screening system comprising the half-barrel intake screen **100** and the standard base **432** is disposed in a water source, water flows through the screen segment **116** to enter the intake screen **100**. Then, the water flows through the flow modifier **218** to the inside of the flow modifier **218**, where the water flows out the bottom **108** of the intake screen **100** to the channel **434** of the base **432**.

As shown in FIG. 4, the intake screen **100** is a partially circular prism in shape and includes a partially circular prism flow modifier **218**, but the intake screen **100** may be any desired shape with at least one flat side as described herein. For certain flow modifiers **218** to work properly, there must be a hollow portion after (i.e., downstream) the flow modifier **218**. In the vaulted base of FIG. 3, the hollow portion is made

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by the vaulted walls **324, 326**. Thus, a flat flow modifier **218** may be used. However, in the standard base, the inside portion of the partially circular prism flow modifier **218** serves as the hollow. Thus, in most instances of a standard base, a flat flow modifier should not be used, unless the channel has enough

FIG. 5 illustrates a half-barrel intake screen **100** with a flow modifier **218** and an airburst system **536** to remove debris from the intake screen segment **116**. The airburst system **536** includes an inlet port **538** in one of the first end **104** or the second end **106** of the frame **102**. The inlet port **538** feeds a connection **540**. At least one conduit **542** with holes **544** split off of the connection **540** and runs the length of the screen segment **116**. For instance, the connection **540** may comprise a T-connection such that two conduits **542** split off the T-connection and run along generally opposite lengths of the intake screen **100** proximate to the screen segment **116**. For instance, as illustrated, the conduit **542** of the airburst backwash system **536** is disposed between the screen segment **116** and the flow modifier **218**. When an air source (not shown) bursts air into the inlet port **538**, the air bursts out of the holes **544** to remove debris that has accumulated on the screen segment **116**.

The airbursts can occur on periodic intervals set by any amount of time. Further, the intervals may be irregular. For example, a channel of a base can have a flow sensor to determine the flow rate of water in the channel. When the flow rate drops below a certain threshold, the airburst system can send an airburst, because the low flow rate indicates that debris may be on the screen.

The half-barrel intake screens **100** described herein provide a large amount of surface area compared to the height of the intake screen. Therefore, the half-barrel intake screens described herein are well suited for shallow water applications. Moreover, the half-barrel screens described herein do not require a T-shaped concrete body to which the screen segment attaches. Thus, the intake screen does not require an outlet pipe. In other words, various embodiments of the half-barrel intake screen utilize a continuous screen segment along the entire length of the half-barrel intake screen. Therefore, the added weight and expense of a concrete body is removed from the intake screen, and there is more surface area per length due to no flow-obstructing concrete body. Further, the non-flat flow modifier creates a hollow portion within the screen itself also eliminating a requirement for a hollow concrete body or a vaulted base.

The block diagrams in the Figures illustrate the architecture, functionality, and operation of possible implementations of systems according to various embodiments of the present invention. In this regard, each block in the block diagrams may represent a module.

The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used herein, the singular forms “a,” “an,” and “the” are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms “comprises” and/or “comprising,” when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof. As noted above, the phrase “partially circular” includes semicircles, quarter circles, three-quarter circles, any amount of a circle, any amount of an ellipse, any amount of an oval, etc.

The corresponding structures, materials, acts, and equivalents of all means or step plus function elements in the claims below are intended to include any structure, material, or act

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for performing the function in combination with other claimed elements as specifically claimed. The description of the present invention has been presented for purposes of illustration and description, but is not intended to be exhaustive or limited to the invention in the form disclosed. Many modifications and variations will be apparent to those of ordinary skill in the art without departing from the scope and spirit of the invention. Aspects of the invention were chosen and described in order to best explain the principles of the invention and the practical application, and to enable others of ordinary skill in the art to understand the invention for various embodiments with various modifications as are suited to the particular use contemplated.

What is claimed is:

1. An intake screen comprising:

a frame including:

a first end;

a second end; and

a bottom coupled between the first end and the second end;

a contiguous screen segment coupled between the first end and the second end of the frame, wherein the contiguous screen segment is coupled to the frame independently of a concrete body having an outlet; and

a flow modifier disposed on the bottom of the frame and running the length of the frame; wherein the bottom includes solid panels that flank the flow modifier.

2. The intake screen of claim 1, wherein the bottom includes an aperture.

3. The intake screen of claim 1, wherein the contiguous screen segment: couples directly to the first end, the second end, and the bottom; and runs the entire length of the intake screen.

4. The intake screen of claim 1, wherein the first end is a partially circular shape.

5. The intake screen of claim 4, wherein:

the second end is a partially circular shape; and

the contiguous screen segment includes a uniform cross section along the length of the intake screen between the first end and the second end.

6. The intake screen of claim 1, wherein the flow modifier is a partially circular prism.

7. The intake screen of claim 1, wherein the flow modifier is flat.

8. The intake screen of claim 1, wherein the flow modifier includes a plurality of holes of a uniform size.

9. The intake screen of claim 1, wherein the flow modifier includes a plurality of holes of a non-uniform size.

10. The intake screen of claim 1, further including an airburst system including:

a conduit with holes; and

an inlet that couples between the conduit and an air source, wherein air from the air source removes debris accumulated on the screen segment.

11. The intake screen of claim 10, wherein the conduit of the airburst system is disposed between the screen segment and a flow modifier.

12. The intake screen of claim 11, wherein the airburst system further includes:

a T-connection; and

a second conduit;

wherein:

the conduit and the second conduit are coupled on opposite ends of the T-connection; and

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the conduit and the second conduit run parallel to the length of the intake screen.

13. The intake screen of claim **1**, wherein bottom of the frame includes a flange.

14. The intake screen of claim **6** further comprising a standard base that does not include a hollow portion that leads to a channel.

15. The intake screen of claim **9** further comprising a vaulted base defining a hollow portion that leads to a channel.

16. The intake screen of claim **12**, wherein the T-connection is located inside of the frame.

17. An intake screen comprising:

a frame including:

a first end;

a second end; and

a bottom coupled between the first end and the second end;

a contiguous screen segment coupled between the first end and the second end of the frame, wherein the contiguous

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screen segment is coupled to the frame independently of a concrete body having an outlet; and

an airburst system comprising:

a conduit with holes;

an inlet that couples between the conduit and an air source,

a T-connection; and

a second conduit;

wherein:

air from the air source removes debris accumulated on the screen segment;

the conduit and the second conduit are coupled on opposite ends of the T-connection;

the conduit of the airburst system is disposed between the screen segment and a flow modifier; and

the conduit and the second conduit run parallel to the length of the intake screen.

18. The intake screen of claim **17**, wherein the T-connection is located inside of the frame.

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UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 9,255,372 B2
APPLICATION NO. : 13/925976
DATED : February 9, 2016
INVENTOR(S) : John Whitaker

Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Claims

Claim 15, column 7, line 8, "intake screen of claim 9" should read --intake screen of claim 7--.

Signed and Sealed this
Tenth Day of May, 2016

A handwritten signature in black ink, reading "Michelle K. Lee". The signature is written in a cursive style with a large, stylized "M" and "L".

Michelle K. Lee
Director of the United States Patent and Trademark Office